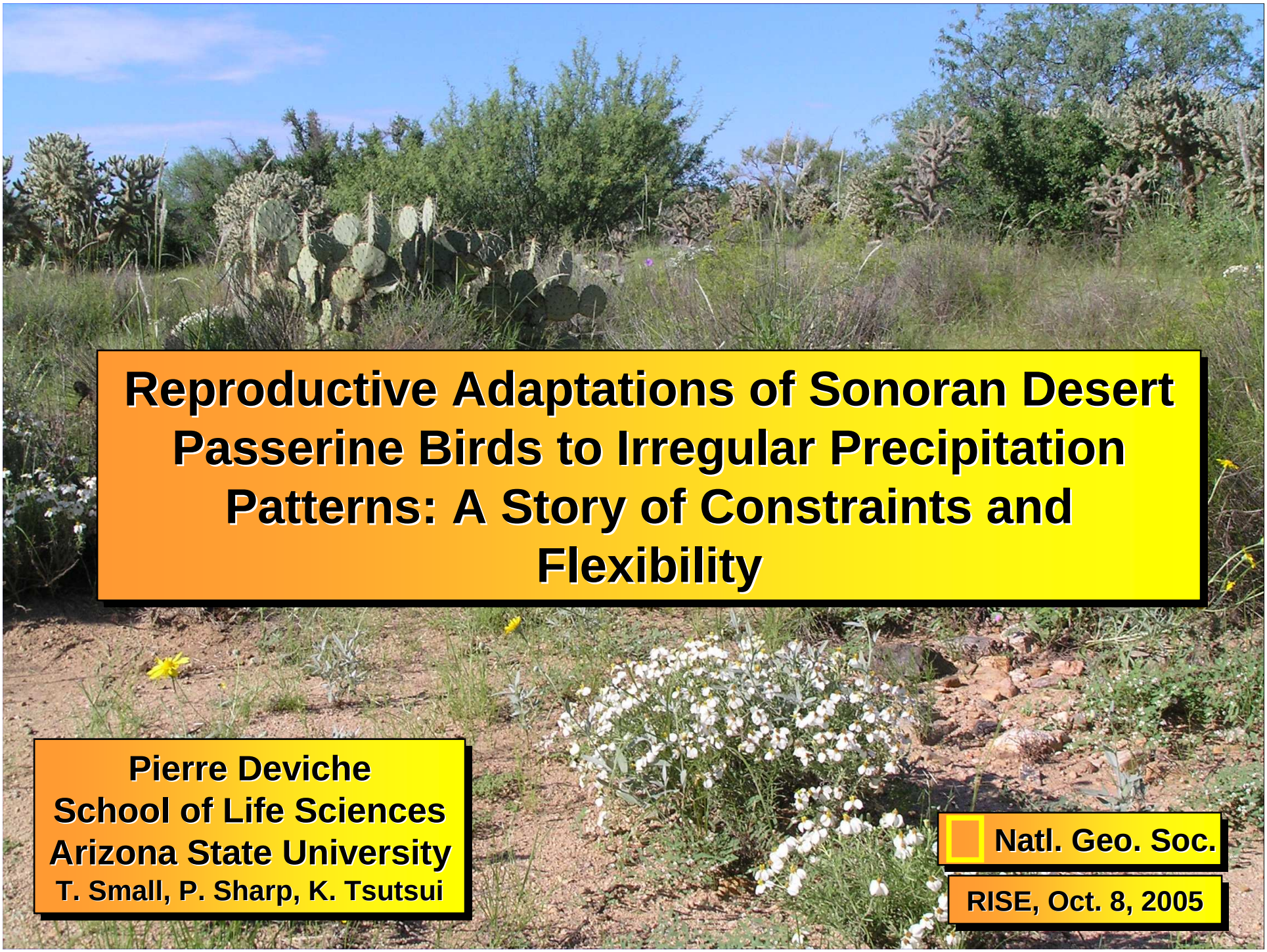

Reproductive Adaptations of Sonoran Desert Passerine Birds to Irregular Precipitation Patterns: A Story of Constraints and Flexibility

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Temperate/high latitude region birds:

- Reproductive cycle of many species well described
- Typically breed in the ***spring***
- Breeding activities cease in ***early summer***

Annual Cycle – Temperate Region Birds

WINTER
Gonads: •

Long Days

SPRING/ EARLY SUMMER
Gonads: ●

Long Days

LATE SUMMER/ FALL
Gonads: •

Short Days


Mid-June


Early September

Rufous-winged Sparrow
(*Aimophila carpalis*)

Cassin's Sparrow
(*Aimophila cassinii*)

Photo/G. Lasley

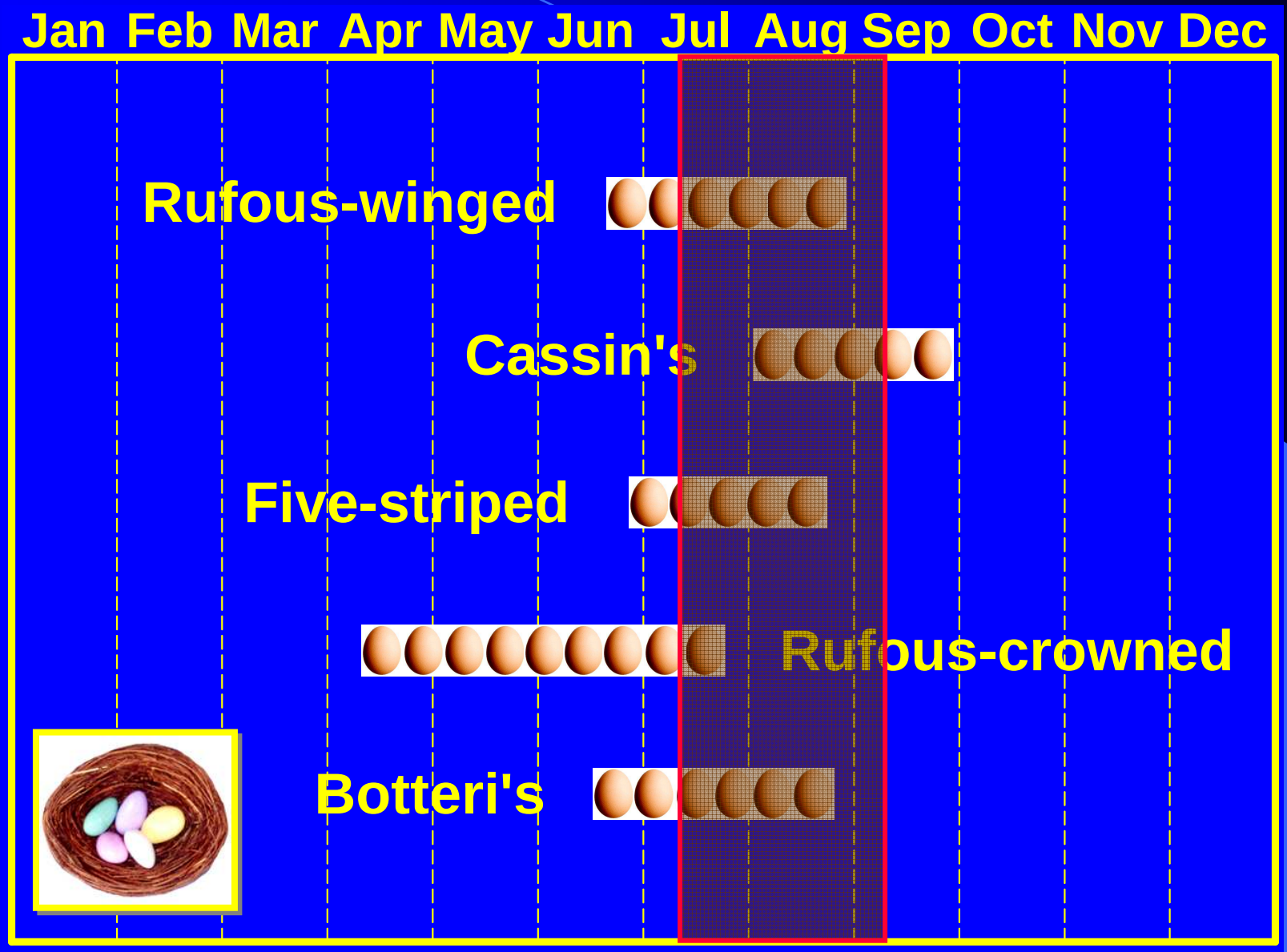
Rufous-crowned Sparrow
(*Aimophila ruficeps*)

Photo/J. Prudente

Botteri's Sparrow
(*Aimophila botterii*)

Photo/G. Lasley

Peak egg dates of *Aimophila* sparrows



What are the questions?

- What factors regulate reproductive cycles in Sonoran desert birds?
- What are the effects of these factors on the reproductive system?
- Do these factors differ fundamentally from those used by temperate region birds?

Rufous-winged Sparrow
Aimophila carpalis

Rufous-winged Sparrow Reproduction:
It's all about rain…


Photo/J. Rowlett

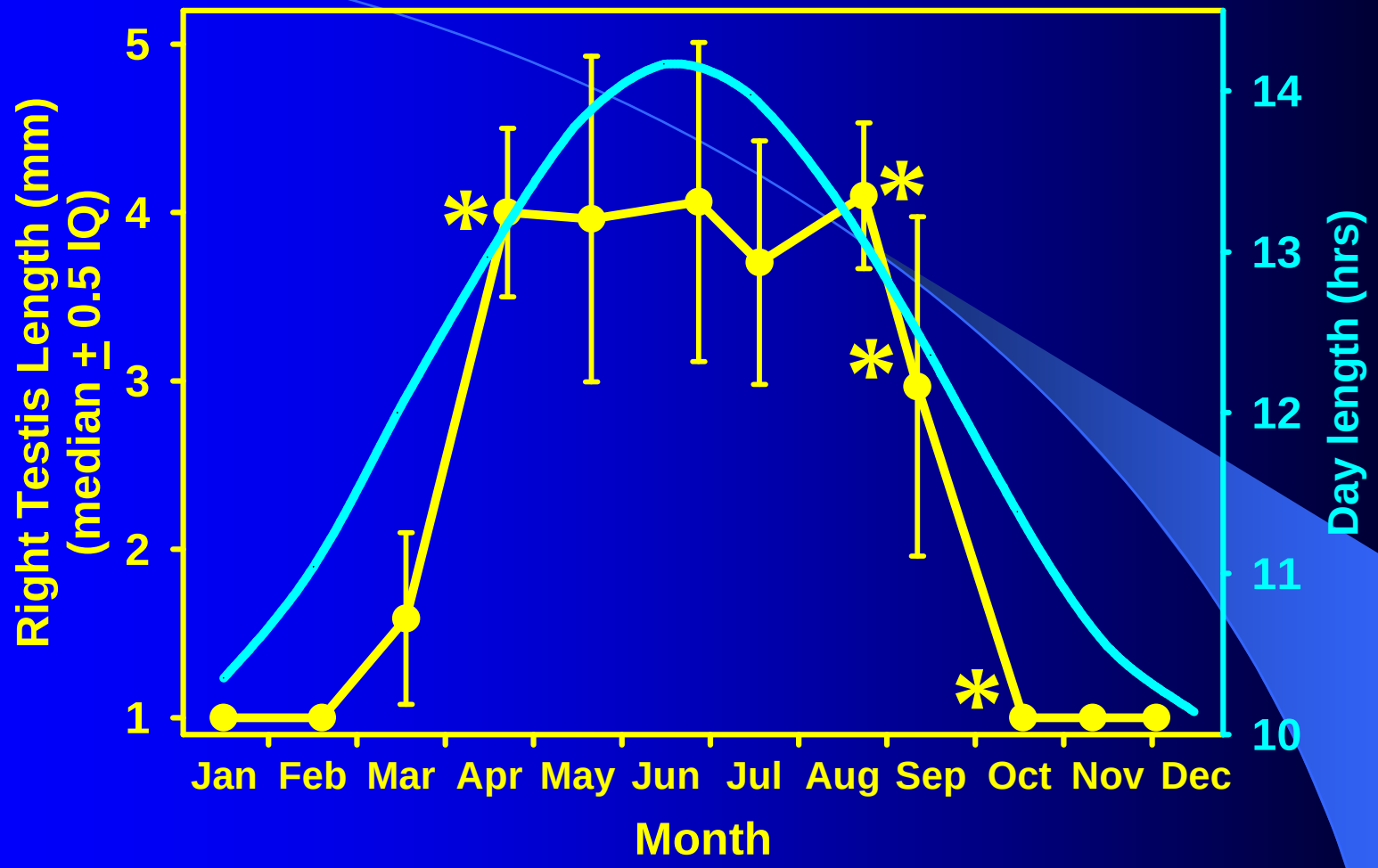
- **…noted for its *late summer rainy season nesting*…(Phillips *et al*., 1978).**

- **Nesting takes place in late April through mid-September, but *nesting is triggered by summer rains* (Rising, 1996).**

- **Of all North American birds, the Rufous-winged Sparrow *may depend the most on rainfall as a stimulus for nesting* (Lowther *et al*., 1999).**

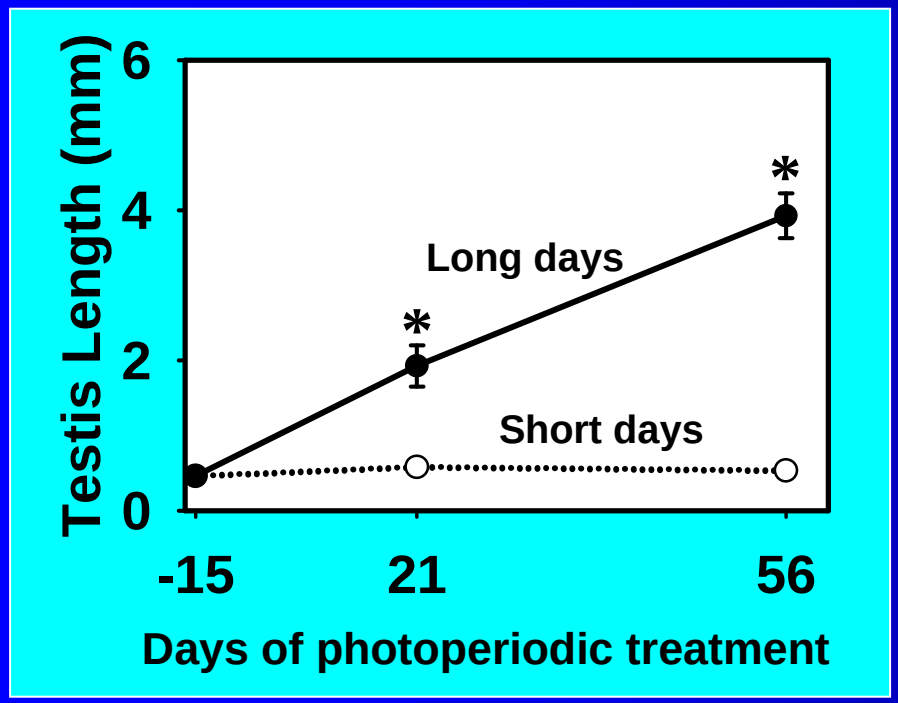
Mist-net birds in the field:

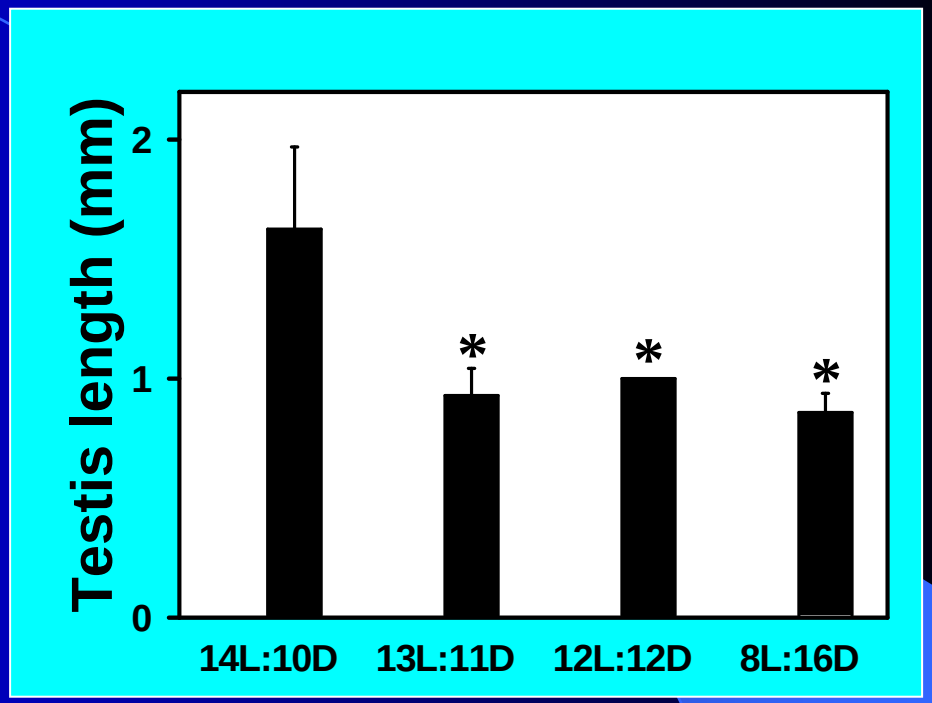
- Collect blood for hormone concentration analysis
- Laparotomize to measure size of gonads
- Bring into captivity



- Testis size in free-ranging sparrows changes seasonally
- Seasonal changes in testis size parallel changes in natural day length

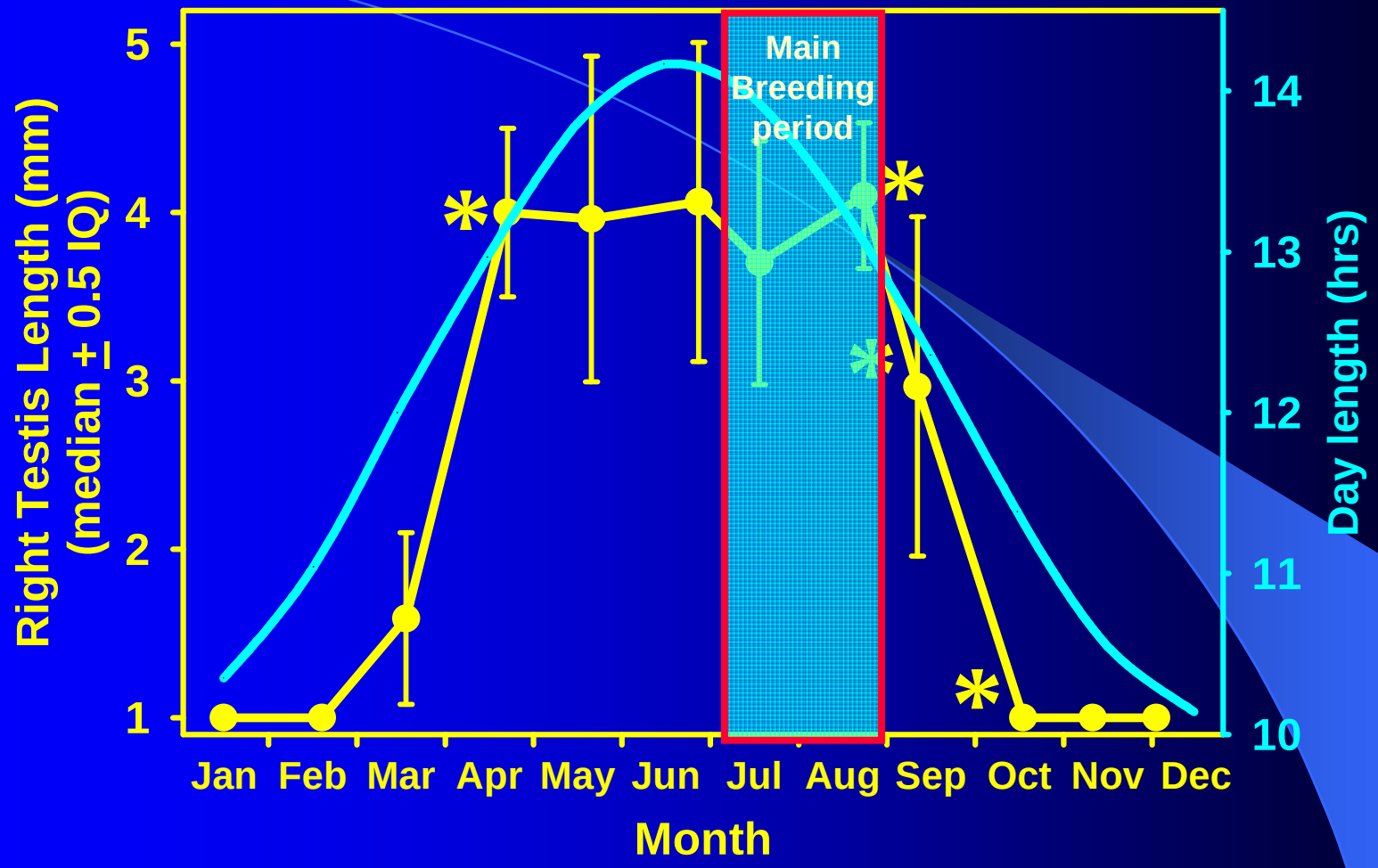
In captive birds…





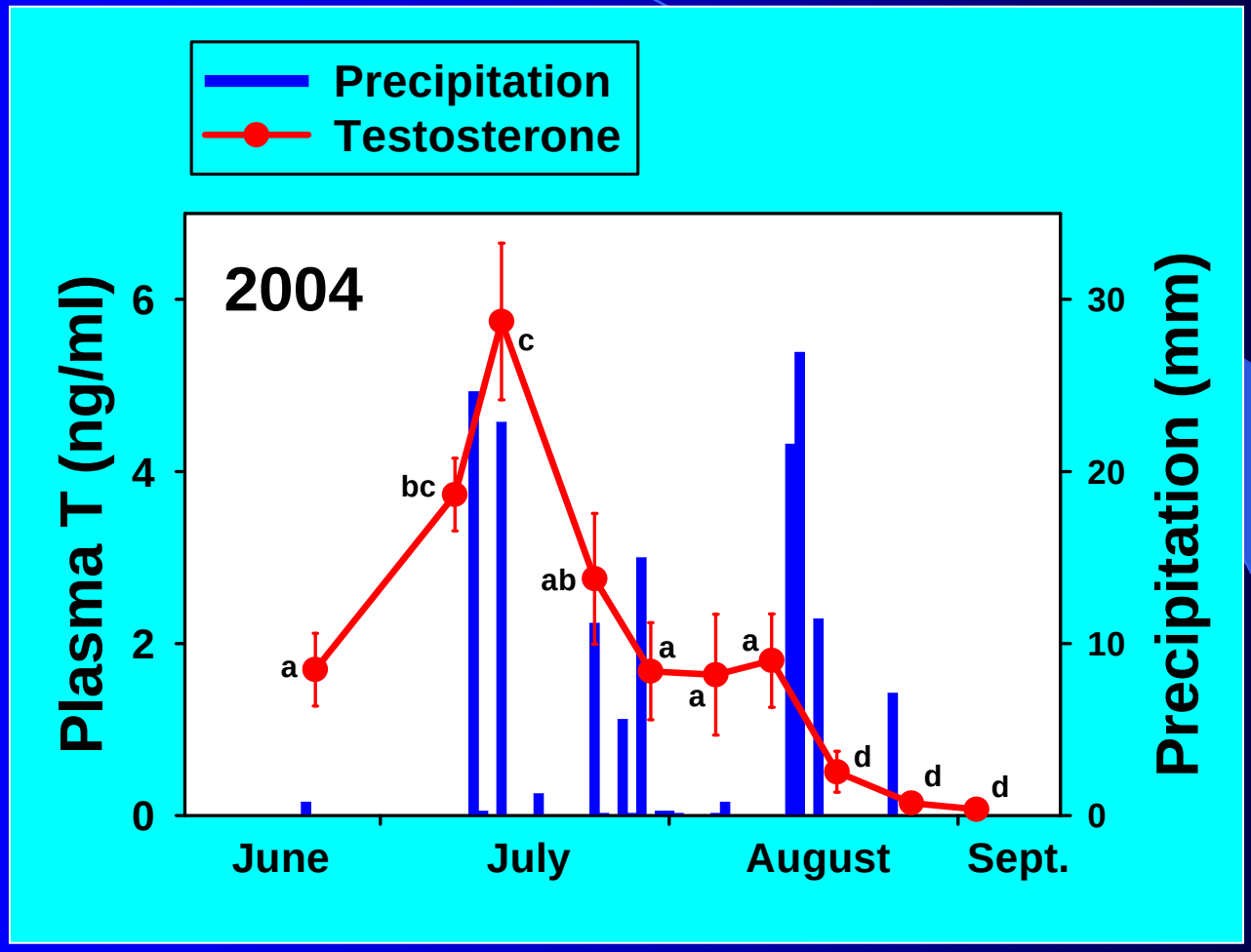
- Transfer from short to long day length stimulates testicular development

- Transfer from long to short day length induces testicular regression

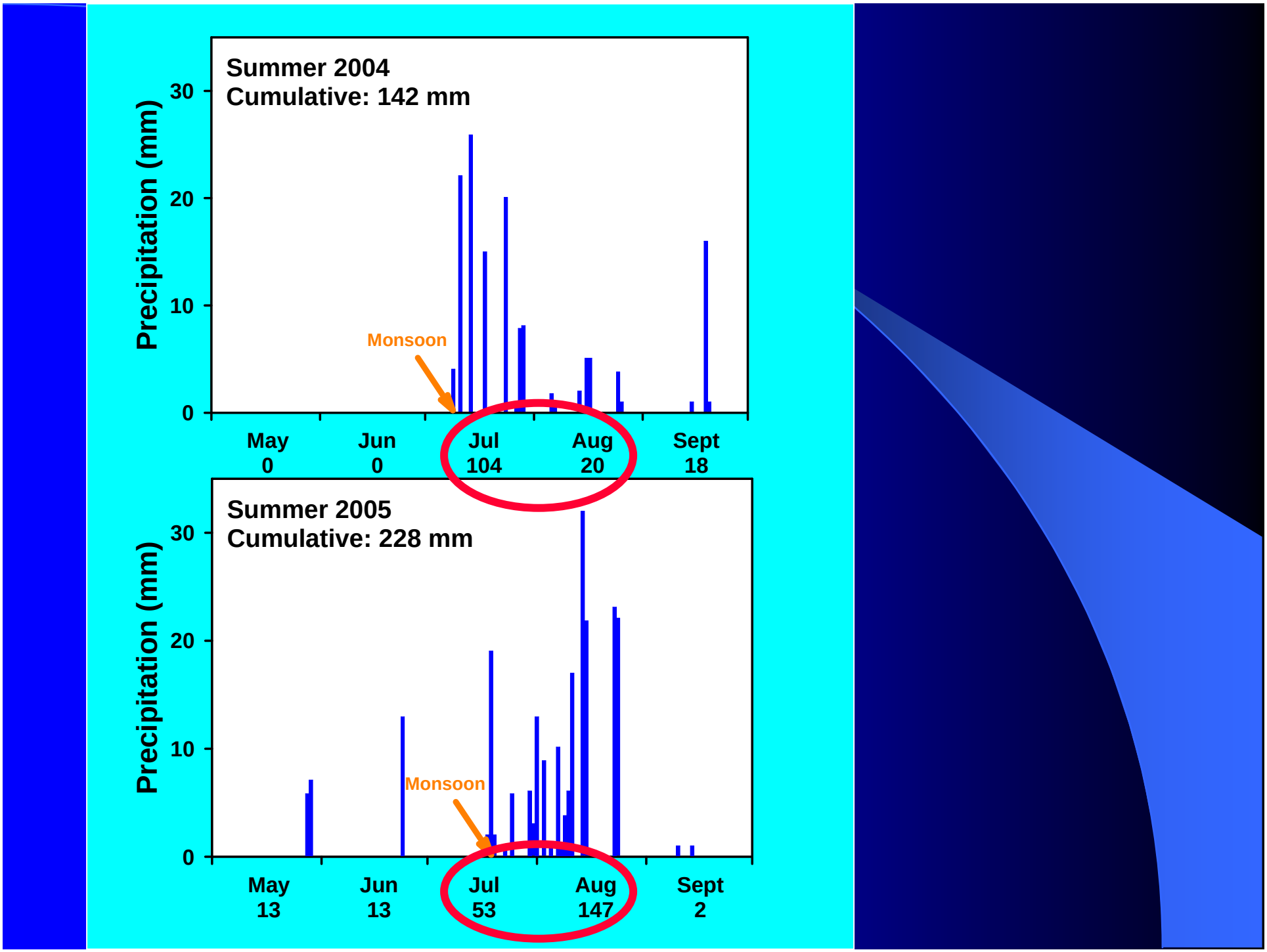


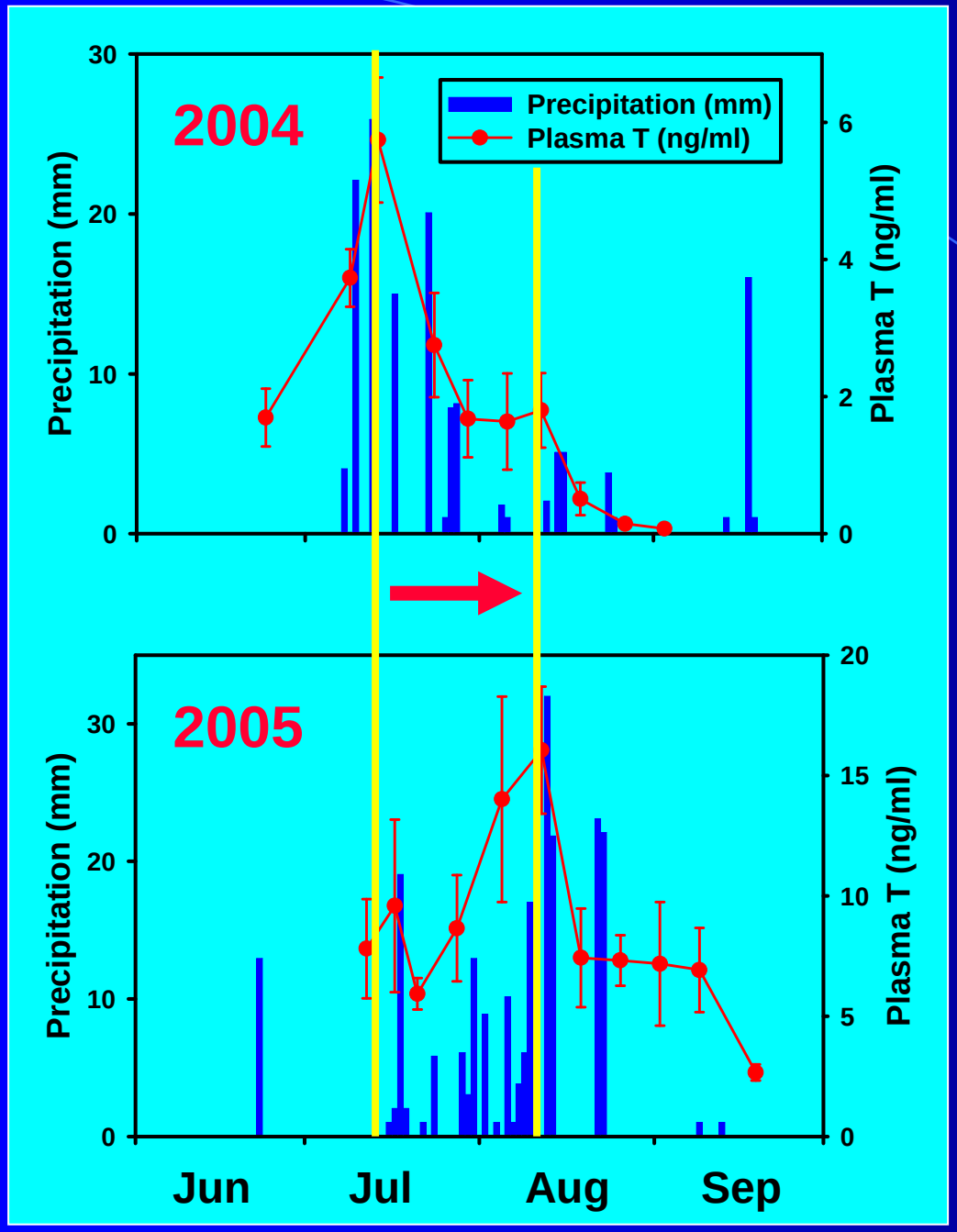
Seasonal changes in natural day length account for seasonal changes in testicular function

Testosterone involved in courtship, defense of breeding territory, reproductive behavior

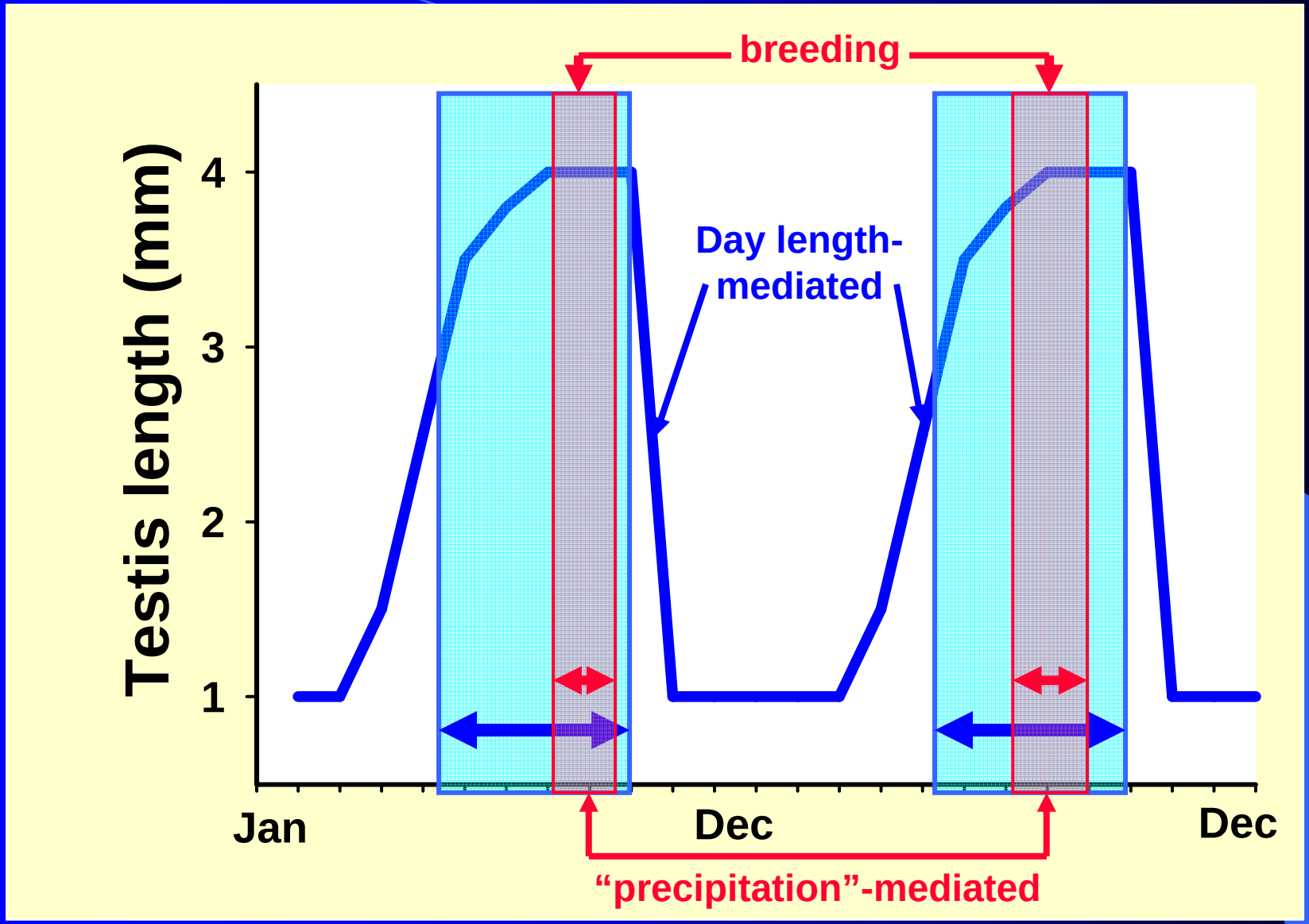


Plasma testosterone increases at the beginning of the monsoon


Summer 2004
Cumulative: 142 mm
Precipitation (mm)
30
20
10
0
Monsoon
May
0
Jun
0
Jul
104
Aug
20
Sept
18
Summer 2005
Cumulative: 228 mm
Precipitation (mm)
30
20
10
0
Monsoon
May
13
Jun
13
Jul
53
Aug
147
Sept
2

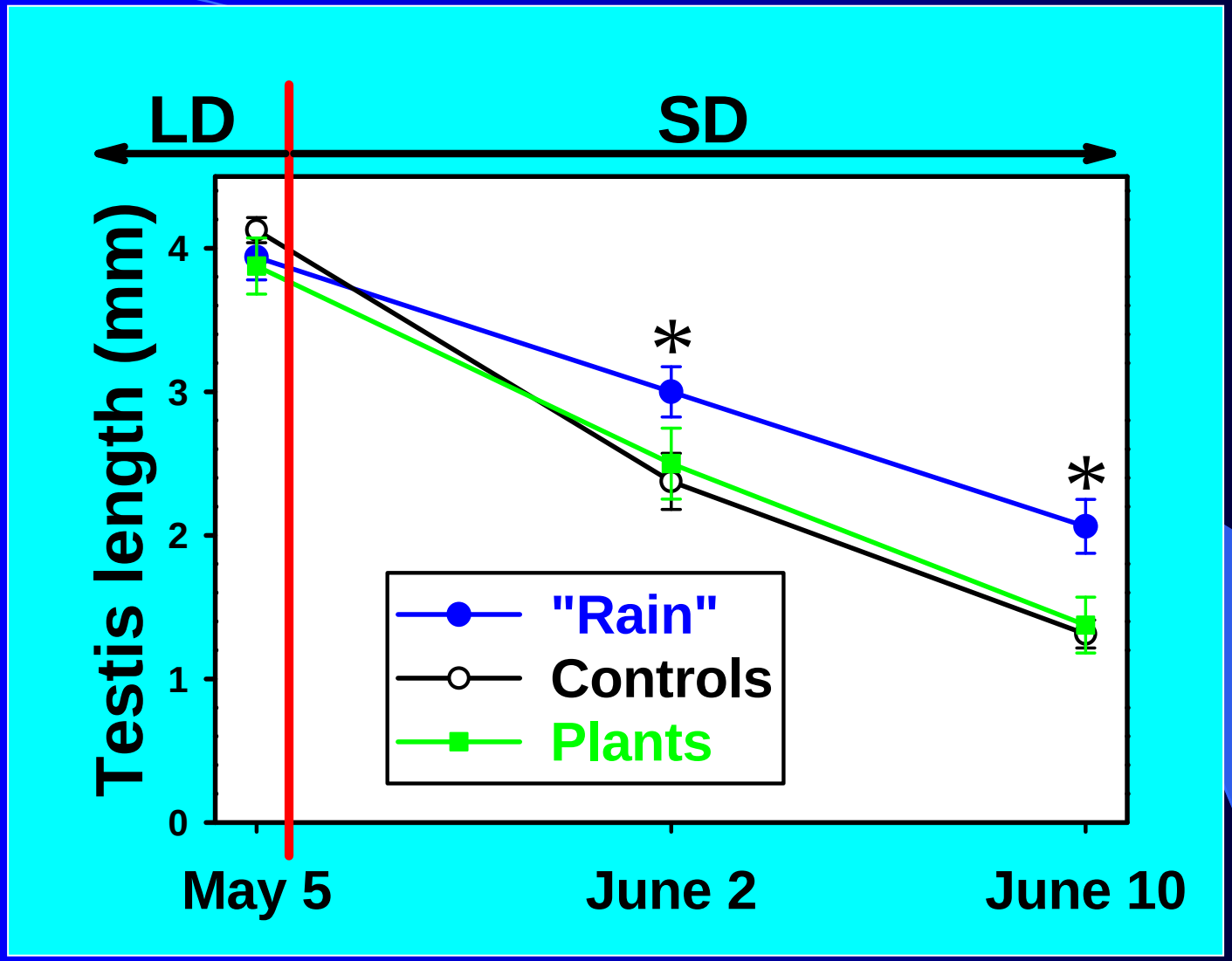


- **Hence: Seasonal changes in plasma testosterone is environment-driven, not intrinsic (= endogenous).**
- **Yearly differences in monsoon rain patterns correlate with differences in circulating concentrations of reproductive hormone.**


breeding
Testis length (mm)
4
3
2
1
Day length-
mediated
Jan
Dec
Dec
“precipitation”-mediated

Does exposure to the sound/sight of artificial rain OR to green plants affect the reproductive system?

“Rain”-exposed **OR** **Plant-exposed**



Exposure to artificial precipitation delays short day-induced reproductive system regression

Conclusions

- Similarities (reliance on day length) and differences (high reliance on precipitation) compared to temperate region birds
- Interesting models for studying integration of multiple environmental variables in the control of reproduction
- Dissociation of seasonal gonadal and reproductive hormone cycles
- Effects of global climate changes on precipitation patterns >> on breeding cycles and population stability?